SECTION 15480
PROCESS HEAT EXCHANGERS FOR NUCLEAR SERVICE

PART 1 - GENERAL

1.1 SCOPE

A. This specification addresses the design, materials, testing and inspection, preparation for shipment and documentation of unfired Process Heat Exchangers. Heat Exchangers include shell and tube, spiral, fin-tube, and other heat transfer configurations.

1.2 INDUSTRY CODES AND STANDARDS

A. The Heat Exchangers shall be designed, fabricated, tested and inspected in accordance with the industry codes and standards listed below:
   1. Standards of Tubular Exchanger Manufacturers Association (TEMA), Eighth Edition.
   2. ASME Boiler and Pressure Vessel Code, 1998 Base with 1999 Addenda, Section VIII, Division 1.
   3. ASNT SNT-TC-1A, 1998.

1.3 RELATED SECTIONS

A. Section 09960, “High Performance Coatings.”

1.4 QUALITY ASSURANCE

A. Process Heat Exchangers shall be furnished by a firm qualified and regularly engaged in this type of work. The firm shall maintain facilities for fabrication of subject items.

B. Materials and products used in the fabrication of Process Heat Exchangers shall be new. Materials shall be furnished and installed in strict accordance with Sub-Tier Supplier's current published recommendations, recognized good practices, Buyer supplied component drawings, and these specifications.

C. The Supplier shall have and maintain approved quality control system that complies with the requirements of ASME Section VIII. The Supplier’s quality control system shall be reviewed and approved by the Buyer.

D. The Buyer reserves the right to access the Supplier's and Sub-Tier Supplier's facilities at which work is being performed. Access shall be provided for any personnel designated by the Buyer. The purpose of accessing the facilities shall be to perform assessments, reviews, surveillance, inspections, investigations, or test witnessing applicable to the work being performed by the Supplier or Sub-Tier Suppliers under this specification.

E. The Supplier shall resolve all deficiencies noted, to the Buyer's satisfaction. The Buyer's concurrence with "use-as-is" or "repair" disposition of any nonconformance must be obtained. Concurrence will not be unreasonably withheld. The terms "use-as-is, "repair, and "rework" are defined below.
   1. "Use-as-is" is a disposition permitted for a nonconforming item when it can be established that the item is satisfactory for its intended use.
   2. "Repair" is the process of restoring a nonconforming characteristic to a condition to ensure that the capability of an item to function reliably and safely is unimpaired, even though that item still does not conform to the original requirements.
   3. "Rework" is the process by which an item is made to conform to the original requirements by completion or correction.

F. Witness and hold points are specific points in the fabrication process requiring witnessing or verification by the Buyer. Activities shall not proceed past a hold point without witness or verification by the Buyer unless specifically waived in writing by the Buyer.

G. All provisions contained herein shall be extended to cover the Sub-Tier Suppliers employed by the Supplier.

PART 2 - PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

A. To prevent plugging and fouling, Heat Exchangers shall be designed using the maximum possible fluid velocities. Fluid velocities shall be selected to prevent erosion, flow induced vibration, and excessive pressure drop. Maximum allowable pressure drop is listed on the equipment data sheet.

B. Minimum fouling factors used in heat transfer calculations shall be as listed in the TEMA standard unless specified otherwise on the equipment data sheet.

C. The Heat Exchanger shall be provided with suitable steel supports with bases drilled for anchor bolts. All but one support on each unit shall have slotted holes to allow for thermal expansion. Component drawings may contain more specific anchoring details.

D. Primary utility nozzles shall include Re-Flange flanges, swagelok tube fittings, or tubing unions with the nozzles facing upward. Nozzle sizes less than ¾" shall not be permitted. Specific nozzle configuration is noted on datasheets or component drawings.

E. High and low points on the process and utility sides of the Exchanger shall be equipped with ¾" vents and drains as necessary to completely vent and drain all exchanger sections.

F. Each exchanger shall be provided with a nameplate in accordance with ASME Section VIII, Division 1 and TEMA code requirements. The pressurized sections of the Exchanger shall be a National Board registered ASME pressure vessel.

G. The function of fin-tube Exchanger housings is to direct process gas over the coils and withstand nominal internal pressure. The fin-tube Exchanger housing does not need to be leak tight.

H. Heat Exchangers shall be designed for a 40-year life.

2.2 MATERIAL REQUIREMENTS

A. Materials are specified on the equipment data sheets. The Supplier, on the fabrication drawings, shall indicate materials not addressed on the data sheets, and indicate the ASME material specifications for all material.

B. Coil tubing shall be seamless.

C. Flat gaskets to be furnished with the Exchanger are specified on the equipment data sheets. Gaskets shall be fabricated using 1/16" sheet material and cut from a single sheet whenever possible. Vulcanized or glued joints are acceptable and shall be indicated on the fabrication drawings.

D. Carbon Steel Heat Exchangers shall be supplied with one coat of primer per Section 09960.

E. Certified Material Test Reports (CMTRs) shall be provided for all Heat Exchanger Components.

PART 3 - EXECUTION

3.1 FABRICATION REQUIREMENTS

A. Controls are to be exercised during all stages of fabrication to minimize exposure of stainless steel to contaminants including chlorides and carbon steel. Any compounds, liquids, or markers that come into contact with stainless steel surfaces shall not contain more than 250 ppm by weight chlorides.

B. Carbon arc or iron powder cutting shall not be used on stainless steel. All cut or raw edges shall be deburred and shall be smooth to the touch.

C. In order to preserve the original finish of stainless steel sheet material, care shall be exercised to prevent scratching, abrading, nicking, and denting during receiving, storage, fabrication and handling. The original protective coating shall be preserved as long as practical.

D. Grinding wheels and wire brushes shall either be new or previously used only on austenitic stainless steel. Wire brushes shall have stainless steel bristles.

3.2 TESTING AND INSPECTION

A. The Supplier shall be responsible for all testing and inspection required by this specification. The Supplier shall provide the test procedure, test location, equipment, instrumentation, and any temporary connections and auxiliary parts necessary to execute the tests. The Supplier shall also provide test personnel qualified to conduct, record, and verify test results.

B. All hold points shall be identified on the Fabrication Schedule and Shop Traveler. For all hold points requiring witness or inspection at the Supplier's facility, the Supplier shall provide ten (10) working days advance written notification to the Buyer so that a Buyer representative may be present at the Supplier's shop. The Supplier shall incorporate, at a minimum, the following fabrication hold points:
1. Fit-up and Weld Preparation Inspection.
2. Leak Tests.
3. Final Assembly Inspection.

C. Equipment shall be inspected by the Supplier prior to shipment. A representative of the Buyer may be present for all test and inspections. The Supplier shall notify the Buyer of all tests and inspections at least ten (10) working days prior to conducting said test or inspection. Required testing and inspection is described below.
1. The general assembly of the Exchangers shall be inspected by the Supplier. The assembly shall conform to the specifications and any documented and agreed upon changes. Inspection shall include general arrangement, dimensions, and component tagging.
2. The Buyer reserves the right to visually inspect all welds at the Supplier's site during site acceptance tests. All welds shall be visually inspected by the Supplier per ASME, Section VIII requirements.
3. All exchangers shall be hydrotested for a minimum of one hour. Individual tests shall be applied to the process and utility sides.
4. Minimum radiographic inspections shall meet the requirements of ASME Section VIII, Division 1, UW-52. Magnetic particle examination, per ASME Section VIII, Division 1, Appendix 6, or liquid penetrant examination, per ASME Section VIII, Division 1, Appendix 8, shall be used for nozzle connection inspections.

D. Instruments used for testing and inspection shall carry a current certification from NIST.

3.3 PACKAGING, DELIVERY, STORAGE, AND HANDLING

A. The Supplier shall thoroughly clean equipment of water, debris, weld splatter, grease, oil, markings from pens and dyes, shop soil, and other foreign matter prior to shipment.

B. The equipment shall not be packaged and shipped until all NDE, testing, and inspection has been performed and the results have been approved by the Buyer.

C. Equipment shall be shipped as completely assembled units. If shipping limitations restrict complete assembly shipments, the Supplier shall propose a recommended alternative for approval by the Buyer. Other components or items that may work loose or be lost in transit shall be packed separately.

D. Ship Process Heat Exchangers mounted on skids or in crates suited for the intended method of transport. Lifting weight on large skids shall be clearly marked on the skid and in the shipping documents.

E. Loose components shall be bagged, identified, and crated separately. Each shipping package shall be labeled with a waterproof label indicating applicable tag number.

F. The Supplier shall completely identify the quantity and location of temporary material contained within the Filter for shipment, handling, or storage.

G. The Supplier shall be responsible for the dimensional stability and overall integrity of the equipment during shipment. Any special lifting, rigging, or setting procedures shall be provided. The center of gravity shall be clearly marked on the equipment skids for hoisting and rigging purposes.

3.4 SUBMITTALS

A. A Fabrication Schedule shall be provided showing all fabrication steps, hold points, tests, and inspections. The Supplier shall provide to the Buyer a revised Fabrication Schedule within seven (7) working days of a modification to the contract, which revises the required delivery date or when other approved Buyer modifications change a scheduled assembly step, hold point, test, or inspection.

B. A current copy of the Supplier's Quality Control System Manual and Certificate of Authorization shall be submitted with the proposal.

C. Completed manufacturer's data report shall be provided prior to shipment.

D. Welding Procedure Specifications (WPS) and supporting PQRs shall be submitted and shall address all joints required for the fabrication of Process Heat Exchangers. The WPSs shall also address weld repair and welding equipment.

E. The Supplier shall provide NDE, test, and inspection procedures for Process Heat Exchangers to the Buyer for review and comment at least two weeks prior to conducting said test, or inspection. Completed reports shall be provided prior to shipment.

F. The Supplier shall submit a complete package of material certifications for all materials used in the fabrication and assembly of items, including, but not limited to, stainless steel sheet, structural steel, welding filler rods, and fasteners. Material certifications shall be legible copies of Certified Mill Test Reports (CMTR) indicating chemical analysis, physical test data and heat

number. Certificates of Conformance (CoC) may be submitted in lieu of CMTRs, with prior approval by the Buyer.

G. The Supplier is responsible for ensuring that all personnel assigned to fabrication, including welding, assembly, testing, and inspection activities are fully qualified to perform their respective job functions. Supplier shall provide Welder Performance qualifications for personnel performance welding activities.

H. Non-Destructive Examination (NDE) personnel performing examinations and testing operations shall be certified per the guidelines of ASNT SNT-TC-1A. All NDE reports shall be signed by personnel holding either Level II or Level III certifications and who either performed or witnessed the activity. The Supplier shall provide the NDE certifications for personnel performing or witnessing non-destructive examinations.

I. A detailed dimensional outline drawing for each Exchanger shall be prepared by the Supplier. The drawings shall clearly indicate nozzle locations and mounting details.

J. The Supplier shall submit a hydrotest procedure and report addressing the requirements of ASME Section VIII.

K. A cleaning procedure shall be submitted addressing the requirements of this specification section.

L. The Supplier shall complete the data sheet provided the Buyer.

M. The Supplier shall prepare documentation packages with the proposal, prior to fabrication, and after fabrication in accordance with table 15480-1.

Table 15480-1 Documentation Requirements

Document Description	*With Proposal*	*Prior to Fabrication*	*Prior to Shipment*
Quality Control System Manual	X		
Certificate of Authorization for Manufacture of Code Items	X		
ASME Manufacturer's Data Report	X*	X*	X
Dimensional Outline Drawings		X	
Hydrotest Procedure		X	
Non-Destructive Examination Procedure Addressing Radiographic, Magnetic Particle, and Liquid Penetrant Examination		X	
Non-Destructive Examination Report Addressing Radiographic, Magnetic Particle, and Liquid Penetrant Examination			X
Hydrotest Report			X
Cleaning Procedure		X	
Completed Data Sheet	X	X	
CMTRs for Exchanger Components		X	X
Welder Performance Qualifications		X	
NDE Personnel Certifications		X	
Fabrication Schedule	X		
Welding Procedure Specifications and Supporting PQRs		X	

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END OF SECTION 15480